

"The interest in the teaching of agriculture," continues the author, "is but a part of a much larger question—the movement for teaching by means of things that have come within the student's experience. The underlying reason why such teaching is desirable is because it brings the schools in touch with the home life—the daily life of the community. A large part of our teaching has had no relation whatever to our daily life."

Thus the author justifies the introduction of agriculture into a high school. The subject is undeniably interesting to elder scholars whether they propose going in for farming or not, but the author goes further, and maintains that it is of real educational value and can be presented in such a way as to train the student to think. Few people would dispute these views, but we have had to wait until now for a little handbook in which they are logically carried out.

The book is not, of course, intended for elementary schools. The author presupposes some knowledge of chemistry and botany, and makes no attempt to gloss over difficulties. It is doubtful whether a scholar could study the subject profitably until he is some sixteen years of age. The author begins with the principles underlying the improvements of plants and animals by crossing and by selection. Mendel's law and its applications are dealt with at length, and mutation forms are also discussed. In illustration of the improvement effected it is shown that the percentage of sugar in the sugar beet has increased from 8 to 18 per cent. or more, whilst maize, cotton and other crops have undergone no less change. The propagation of plants forms the subject of the next chapter. Root stocks, tubers, cuttings, grafting, budding, are described in some well-illustrated pages, and then we pass to the consideration of seeds and germination tests. The student is thus led to the study of the food required by the young plant; he finds that at first it comes from the seed, afterwards from the air and the soil. A brief sketch is given of the processes going on within the plant, the manufacture of plant food, and so on. The soil is next considered; it is shown to consist of small rock particles, soil water, soil air, decaying organic matter, and living organisms, all of which are dealt with in some detail. As usual in American books great stress is laid on the importance of soil water. The reason is very obvious; two-fifths of the United States is too dry to raise good crops without irrigation, and the Government is building large reservoirs for storing irrigation water. Further, dry farming is practised there to a greater extent than anywhere else as yet. On the other hand, on the Atlantic coast the water supply is sometimes too great and a good deal of the land requires draining.

The author discusses at some length the methods for maintaining the fertility of the land. Soils have become productive by lying for ages in prairie or forest condition whilst organic matter has gradually accumulated until some sort of equilibrium is attained. With the advent of man the equilibrium is upset, the prairie is broken up, grain is grown for many years, and the wastage, which in any case would be considerable, is increased by the common

habit of burning the straw of the crops. Only in old, long-settled countries is the full value of farmyard manure appreciated. "Very few farmers in any part of America," says the author, "have yet learned to handle manure without losing one-half of its value." Among the causes of decreased productivity, erosion by wind or water is considered the worst, but it may be prevented by keeping the soil in crop as much as possible. Exhaustion of the humus supply is, however, regarded as the fundamental cause for the decrease in crop yields. Methods of restoring the fertility of the soil by means of manures, green crops, and animal excretions are described. Then follow some interesting chapters on the various crops—maize, cotton, wheat, timber and so on—their economic importance, their methods of cultivation, and the pests to which they are liable. Finally, there is a discussion on the feeding of animals.

The treatment quite justifies the author's claim that agriculture is a suitable subject for training the mind. The book is conceived in a scientific spirit, and executed with great skill. It is just the book for the young agricultural student, or, indeed, for any young student. All the illustrations are, naturally, American, but the teacher on this side will find it very useful in making up his course, although he will probably wish that an equally good book written from an English standpoint was available.

ELECTRONIC THEORY OF MATTER.

I.a Radioattività. A. Battelli, A. Occhialini, S. Chella. Pp. xxxii+xii+438. *Atti della fondazione scientifica Cagnola dalla sua istituzione in Poi.* Vol. xxii. (Milano, 1909.)

TWO of the most noticeable features of Continental publications of a scientific character are, first, the number written in a semi-scientific manner for popular consumption, and, secondly, the variety dealing with special branches of chemistry or physics in a manner capable of being readily followed by men of science interested chiefly in other branches of these subjects. The present volume is an excellent example of the second class. The first part consists of reports on essays concerned with different subjects, and is followed by the work of Prof. Battelli and his coadjutors, to whom a prize of 2500 lire and a medal were awarded for their memoir on "The Discovery of Radio-activity and its Influence on Physical and Chemical Theory."

In this book of 438 pages the chief facts of radio-activity are set forth in a most interesting and lucid style, and their bearing on chemical affinity, the electronic theory of matter, and the periodic law is discussed in a manner equally able. The standard books on conduction in gases and radio-activity usually contain too much detail, except for experts in these branches of physics; the present authors do not profess to give a full account of the facts, but only of those that are necessary to show the development of recent theory. Great praise is due, not only for the clearness with which these facts are dealt, but also for the skilful choice of material from a large mass

of detail. No book of a similar scope is published in English, and it may be recommended without hesitation to students desiring a succinct statement of facts and their bearing on modern theories of matter. Having said so much, we may perhaps be permitted to point out various small blemishes.

Chapter i. gives an account, in forty pages, of the chief results obtained by the study of gaseous conduction. The usual revolving paddle-wheel is given as an instance of the mechanical effects produced by kathode rays, but it has been shown by Stark that this is due to the heating and not to the momentum of the rays. The properties of positive rays are given in one short paragraph; as they are of outstanding interest at the present time, it might have been expected that something more recent than W. Wien's original experiments would be mentioned.

On p. 61 the extinguishing action of radium on a long spark is ascribed to the conductivity produced, but, as Peck and the present writer have shown, a far greater conductivity may be produced by Röntgen rays without producing extinction.

Chapter iii. should be especially useful to chemists, dealing as it does with the instruments used and the methods of standardising them; Wilson's tilted electroscope might have been included.

On p. 127 a method is given of demonstrating the positive charge carried by α rays; actually the indications of the electroscope would be the same if the rays were uncharged; all the experiment shows is that the β rays are charged negatively. The proper demonstration is given later.

The deduction of the transformation constants from the decay curves is exceptionally well done, as is also the question of electromagnetic mass. In connection with the latter, Sir J. J. Thomson has given reasons for thinking that the number of electrons in an atom is small; these reasons should have been mentioned in the discussion of atomic architecture.

Chapter xi. gives an account of conduction in metals according to the electronic theory. A difficulty, not mentioned here, is the fact that on this theory, according to Thomson, the energy required to raise, say, a gram of silver one degree is about ten times that shown by experiment.

Finally, in a book of such a scope we should expect to find some reference to the work of Campbell and others on the radio-activity of the commoner elements.

R. S. W.

POPULAR ASTRONOMY.

- (1) *Astronomical Curiosities, Facts and Fallacies.* By J. Ellard Gore. Pp. x+370. (London: Chatto and Windus, 1909.)
- (2) *Curiosities of the Sky. A Popular Presentation of the Great Riddles and Mysteries of Astronomy.* By Garrett P. Serviss. Pp. xvi+268. (New York and London: Harper and Brothers, 1909.) Price 6s. net.

IT is admittedly unwise to judge a book by its cover. It would seem to be quite unsafe to judge it by its title. Two books, by a quaint coincidence very alike in their titles, demand notice

together. Notwithstanding their initial similarity, they each appeal to a distinctly different class of readers.

(1) To anyone with an already developed interest in general astronomy the collection of "curious facts, fallacies and paradoxes" contained in Mr. Gore's book will doubtless prove interesting and suggestive. It does not pretend to tell a connected story. It certainly does not. Neither does it present a fairly complete picture of the astronomy of to-day. Elements of the subject are not dealt with, and facts loom larger than theories. It is essentially a book of "extras."

The information given, which the author believes will not be found in popular works on astronomy, has apparently been gleaned mostly, though of course not exclusively, from English and American publications of recent years. Each fact is presented in all its individuality with a local habitation and a name. It is in effect an excellent astronomical scrap-book, with the scraps arranged into chapters and with references scrupulously and copiously given.

The sun and the planets are each dealt with in sequence. The first nine pages contain statements about the sun's "stellar magnitude," temperature, possible length of life and source of heat. Remarks as to the discovery of argon and neon in the sun's chromosphere (which is probably an erroneous identification), about various observations of D_3 and concerning the discovery of sun-spots, all find a place in this first chapter. From this some rough idea of the character of the work may be gathered. Considering the great and growing importance of solar physics, this chapter might have been enlarged with profit. To allot no more space to the sun than to each of the planets in turn is surely an unbalanced treatment. The succeeding chapters devoted to comets, to double, binary and variable stars, and to nebulae, will be found closely packed with information. Following these comes a rather large section of 73 pages concerned with mythological and modern details about the constellations and their included stars. The temperament that found a dictionary the most readable of books would have gloried in these chapters. That the general reader will struggle through them it is difficult to believe.

It is not to be supposed because the work suffers from its limitations that it is not valuable. As a well-written compendium of facts it satisfies a distinct want. Where such want exists it can be recommended. The book is well printed and bound. It is fully indexed, and is light and pleasant to handle.

(2) "Curiosities of the Sky" is a book of quite another type. Here the selecting hand of the artist has been at work. "Facts" are included only when they help the presentation of the subject. The series of chapter-essays into which the publication is divided are excellently written and generally well informed. Astronomical "coal sacks," under the title of "The Windows of Absolute Night," star clusters, star streams and stellar migrations form the subject-matter of the first fifty pages. An interesting chapter on the passing of the constellations follows. Here the